Robust Summaries for

Carbonic Acid, Oxydiethylene Diallyl Ester (CAS No. 142-22-3)

Existing Chemical	:	ID: 142-22-3
CAS No.	:	142-22-3
EINECS Name	:	diallyl 2,2'-oxydiethyl dicarbonate
EINECS No.	:	205-528-7
Molecular Weight	:	274.3
Structural Formula	:	C=CCOC(OCCOCCOC(OCC=C)=O)=O
Molecular Formula	:	C12H18O7

Producer Related Part

Company	:	Great Lakes Chemical Corporation and PPG Industries, Inc.
Creation date	:	10.09.2001

Substance Related Part

Company	:	Great Lakes Chemical Corporation and PPG Industries, Inc.
Creation date	:	10.09.2001
Memo	:	
Printing date	:	20.01.2006
Revision date	:	20.01.2006
Date of last Update	:	20.01.2006
Number of Pages	:	45
Chapter (profile)	:	Chapter: 1, 2, 3, 4, 5
Reliability (profile)	:	Reliability: without reliability, 1, 2, 3, 4
Flags (profile)	:	Flags: without flag, confidential, non confidential, WGK (DE), TA-Luft (DE), Material Safety Dataset, Risk Assessment, Directive 67/548/EEC, SIDS

1.0.1 OECD AND COMPANY INFORMATION

Great Lakes Chemical Corporation
P.O. Box 2200
West Lafayette, IN 47996-2200
765-497-6100
765-497-6303

PPG Industries, Inc.
One PPG Place
Pittsburgh, PA 15272
412-434-3131
412-434-2137

1.0.2 LOCATION OF PRODUCTION SITE

1.0.3 IDENTITY OF RECIPIENTS

1.1 GENERAL SUBSTANCE INFORMATION

Substance type	:	Organic
Physical status	:	Liquid
Source	:	National Library of Medicine, Hazardous Substances Data Bank, 2001

1.1.0 DETAILS ON TEMPLATE

1.1.1 SPECTRA

1.2 SYNONYMS

2,5,8,10-Tetraoxatridec-12-enoic acid, 9-oxo-, 2-propenyl ester
11.09.2001

Allyl diglycol carbonate
17.10.2001

Carbonic acid, oxydi-2,1,-ethanediyl di-2-propenyl ester
17.10.2001

Carbonic acid, oxydiethylene diallyl ester
11.09.2001

CR-39 monomer
17.10.2001

DAGC
17.10.2001

Diallyl diglycol carbonate
17.10.2001

Diallylglycol carbonate
23.10.2001

Diethylene glycol bis(allyl carbonate)
17.10.2001

Diethylene glycol diallyl dicarbonate
17.10.2001

1.3 IMPURITIES

1.4 ADDITIVES

1.5 QUANTITY

1.6.1 LABELLING

1.6.2 CLASSIFICATION

1.7 USE PATTERN

Type	:	Industrial
Category	:	Basic industry: basic chemicals
Remark	:	Diallyl diglycol carbonate is used as a monomer to be incorporated into allyl resins by polymerization. Its main use is an industrial intermediate to make optical polymers
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from National Library of Medicine, Hazardous Substances Data Bank, 2001
Reference	:	(11)

1.7.1 TECHNOLOGY PRODUCTION/USE

1.8 OCCUPATIONAL EXPOSURE LIMIT VALUES

1.9 SOURCE OF EXPOSURE

1.10.1 RECOMMENDATIONS/PRECAUTIONARY MEASURES

1.10.2 EMERGENCY MEASURES

1.11 PACKAGING

1.12 POSSIB. OF RENDERING SUBST. HARMLESS

1.13 STATEMENTS CONCERNING WASTE

1.14.1 WATER POLLUTION

1.14.2 MAJOR ACCIDENT HAZARDS

1.14.3 AIR POLLUTION

1.15 ADDITIONAL REMARKS

1.16 LAST LITERATURE SEARCH

1.17 REVIEWS

1.18 LISTINGS E.G. CHEMICAL INVENTORIES

TSCA

2.1 MELTING POINT

Value	:	= -4 - 0 ° C
Decomposition	:	no
Sublimation	:	no
Method	:	other
Year	:	1955
GLP	:	no data
Test substance	:	as prescribed by 1.1 – 1.4
Source	:	Great Lakes Chemical
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from IUCLID data set produced by European Chemicals Bureau, creation date 11-FEB-2000.

11.09.2001 (1)

2.2 BOILING POINT

Value	:	= 160 ° C at 2.67 hPa
Decomposition	:	no
Method	:	other
Year	:	1950
GLP	:	no data
Test substance	:	as prescribed by 1.1 – 1.4
Source	:	Great Lakes Chemical
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from IUCLID data set produced by European Chemicals Bureau, creation date 11-FEB-2000.

11.09.2001 (24)

2.3 DENSITY

Type	:	relative density
Value	:	= 1.143 g/cm^3 at 20° C
Method	:	other
Year	:	1994
GLP	:	no data
Test substance	:	as prescribed by 1.1 – 1.4
Source	:	Great Lakes Chemical
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from IUCLID data set produced by European Chemicals Bureau, creation date 11-FEB-2000.

11.09.2001 (1)

2.3.1 GRANULOMETRY

2.4 VAPOUR PRESSURE

Value	:	ca. .00146 hPa at 25° C

Decomposition	:	no
Method		other (calculated)
Year	:	2001
GLP	:	not applicable
Test substance	:	as prescribed by 1.1 – 1.4
Remark	:	The vapor pressure was estimated using the EPIWIN/MPBPWIN Program (v1.40). The vapor pressure calculation used a boiling point of 300 degrees C as an input. The calculation was done by the Antoine, Modified Grain, and Mackay methods, with the Modified Grain Method preferentially adopted.
Reliability	:	(2) valid with restrictions. Data were obtained by modeling.

22.10.2001

2.5 PARTITION COEFFICIENT

Log pow (Kow)	:	ca. 1.543 at 20° C
Method		other (calculated)
Year	:	2001
GLP	:	not applicable
Test substance	:	as prescribed by 1.1 – 1.4
Method	:	The Log Kow was calculated using the EPIWIN/KOWWIN Program (v1.66). This program calculates Log Kow by determining Log Kow contributions from individual molecular fragments and then summing up these contributions.
Reliability	:	(2) valid with restrictions. Data were obtained by modeling.

11.09.2001

2.6.1 WATER SOLUBILITY

Value	:	< .1 g/l at 20 ° C
Method	:	other
Year	:	1995
GLP	:	no data
Test substance	:	as prescribed by 1.1 – 1.4
Source	:	Great Lakes Chemical
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from IUCLID data set produced by European Chemicals Bureau, creation date 11-FEB-2000.

11.09.2001

2.6.2 SURFACE TENSION

2.7 FLASH POINT

Value	:	= 173 ° C
Method	:	other
Year	:	1995
GLP	:	no data
Test substance	:	as prescribed by 1.1 – 1.4

Source	:	Great Lakes Chemical
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from IUCLID data set produced by European Chemicals Bureau, creation date 11-FEB-2000.

11.09.2001

2.8 AUTO FLAMMABILITY

2.9 FLAMMABILITY

2.10 EXPLOSIVE PROPERTIES

Result	:	not explosive
Method	:	Directive 84/449/EEC, A.14 "Explosive Properties"
Year	:	1995
GLP	:	no data
Test substance	:	as prescribed by 1.1 – 1.4
Source	:	Great Lakes Chemical
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from IUCLID data set produced by European Chemicals Bureau, creation date 11-FEB-2000.

11.09.2001

2.11 OXIDIZING PROPERTIES

Result	:	no oxidizing properties
Method	:	Directive 84/449/EEC, A.17 "Oxidizing Properties"
Year	:	1995
GLP	:	no data
Test substance	:	as prescribed by 1.1 – 1.4
Source	:	Great Lakes Chemical
Reliability	:	(2) valid with restrictions. Original reference was not available. Information came from IUCLID data set produced by European Chemicals Bureau, creation date 11-FEB-2000.

11.09.2001

2.12 ADDITIONAL REMARKS

3.1.1 PHOTODEGRADATION

Type	:	air
Light source	:	other
Light spect.	:	nm
Rel. intensity	:	based on Intensity of Sunlight
Direct photolysis		
Half-life t1/2	:	ca. .1 day
Method	:	other (calculated)
Year	:	2001
GLP	:	not applicable
Test substance	:	as prescribed by 1.1 – 1.4
Method	:	The photodegradation half-life is calculated using the EPIWIN/AOPWIN Program (v1.90). The hydroxyl radical rate constant was calculated to be 73.2806 E-12 cm^3/molecule-sec, based on the sum of contributions of individual rate constants for each active functional group on the molecule. The overall rate constant was then used to calculate the half-life assuming the hydroxyl radical concentration is constant and assuming first order reaction kinetics.
Reliability	:	(2) valid with restrictions. Data were obtained by modeling.
11.09.2001		

3.1.2 STABILITY IN WATER

Type	:	abiotic
t1/2 pH4	:	> 1 year at 25 °C
t1/2 pH7	:	= 280 day(s) at 25 °C
t1/2 pH9	:	= 68.4 hour(s) at 25 °C
Deg. product	:	
Method	:	OECD Guideline 111 "Hydrolysis as a Function of pH"
Year	:	2005
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4

Method :

Procedure:
(1) Specification of buffer solutions

Buffer sol. Components: Concentration (m.mol dm-3)

4 Potassium hydrogen phthalate: 2.5

7 Disodium hydrogen orthophosphate (anhydrous): 1.5
Potassium dihydrogen orthophosphate: 1
Sodium chloride: 1

9 Disodium tetraborate: 0.5
Sodium chloride: 1

The buffer solutions were filtered through a 0.2 μm membrane filter to ensure they were sterile before beginning the test. Also, these solutions were subjected to ultrasonication and degassing with nitrogen to minimise dissolved oxygen content.

(2) Preparation of samples: Sample solutions were prepared in stoppered glass flasks at a nominal concentration of 0.05 g/l in the three buffer solutions. A 1% co-solvent of acetonitrile was used to aid solubility. The solutions were shielded from light while maintained at the test temperature.

(3) Preliminary test
Sample solutions at pH 4 and 7 were maintained at 50.0 ± 0.5°C for a period of 120 and 360 hours, respectively. As rapid hydrolysis was expected at pH 9, no preliminary test was undertaken.

(4) Definitive Test
Results from the preliminary test showed it was necessary to undertake further testing at pH 7, with solutions being maintained at 60 and 70 ± 0.5°C. This was due to the hydrolysis rate being greater than 10% after 5 days at 50°C. Due to the anticipated rapid hydrolysis at pH 9, solutions were maintained at 20 and 30 ± 0.5°C.

(5) Analysis of sample solutions
Aliquots of the sample solutions were taken from the flasks at various times and the pH of each solution recorded. The concentration of the sample solution was determined by high performance liquid chromatography with mass spectroscopy (HPLC-MS). Duplicate aliquots (A and B) of sample solution were diluted by a factor of 50 using acetonitrile. Duplicate standard solutions of test material were prepared in acetonitrile:respective buffer (98:2 v/v) at a nominal concentration of 1 mg/l. The standard and sample solutions were analysed by HPLC-MS.

(6) Treatment of results
Graphs of the common logarithm of the concentration (g/l) versus time (hours) were plotted for pH 7 and pH 9 and the rate constant and half-life calculated. By plotting the natural logarithm of the rate constants against the reciprocal of the temperature (K), the rate constant and half-lives at 25°C were obtained by either interpolation or extrapolation.

Result : Preliminary test:

The test material concentrations at the given time points are shown in the following tables:

pH 4 at 50.0 ± 0.5ºC

	Time (Hours)		
	0	24	120
Conc. (g/l)	5.03 x 10-2	4.99 x 10-2	4.97 x 10-2
% of initial	-	99.3	98.9

Result: Less than 10% hydrolysis after 5 days at 50°C, equivalent to a half-life greater than 1 year at 25°C.

pH 7 at 50.0 ± 0.5ºC

Time (hrs)	Conc. (g/l)	Log 10 conc. (g/l)	% of initial
0	5.03 x 10-2	-1.30	-
24	4.60 x 10-2	-1.34	91.5
96	3.64 x 10-2	-1.44	72.4
192	2.86 x 10-2	-1.54	57.0
264	2.41 x 10-2	-1.62	48.0
360	1.72 x 10-2	-1.76	34.3

Result: Slope = -1.25 x 10-3
kobs = 2.87 x 10-3 hour-1 = 7.97 x 10-7 second-1
t½ = 242 hours
The extent of hydrolysis after 360 hours indicated that a further test was required to estimate the rate constant and half-life.

Definitive Test:

The test material concentrations at the given time points are shown in the following tables:

pH 7 at 60.0 ± 0.5ºC

Time (hrs)	Conc. (g/l)	Log10 conc. (g/l)	% of initial
0	5.15 x 10-2	-1.29	-
23.5	3.98 x 10-2	-1.40	77.3
72.5	2.42 x 10-2	-1.62	47.0
120.5	1.53 x 10-2	-1.82	29.7

Result: Slope = -4.36 x 10 -3
kobs = 1.00 x 10-2 hour-1 = 2.79 x 10-6 second-1
t½ = 69.0 hours

pH 7 at 70.0 ± 0.5ºC

Time (hrs)	Conc. (g/l)	Log10 conc. (g/l)	% of initial
0	5.13 x 10-2	-1.29	-
23.5	2.55 x 10-2	-1.59	49.6
29.0	2.15 x 10-2	-1.67	41.9
47.0	1.30 x 10-2	-1.87	25.3

Result: Slope = -1.27 x 10-2

kobs = 2.93 x 10-2 hour-1 = 8.14 x 10-6 second-1
t½ = 23.7 hours

The Arrhenius plot was constructed using the data shown in the following tables:

pH 7 Arrhenius Data

T (ºC)	50	60	70
T (K)	323	333	343
1/T(K)	3.10 x 10-3	3.00 x 10-3	2.91 x 10-3
1 kobs(hr-1)	2.87 x 10-3	1.00 x 10-2	2.93 x 10-2
ln kobs	-5.85	-4.60	-3.53

From the graph of the above data, the rate constant and half-life at 25°C have been estimated to be as follows:
kobs = 1.03 x 10-4 hour-1 = 2.87 x 10-8 second-1
t½ = 6.72 x 103 hours = 280 days

pH 9 at 20.0 ± 0.5ºC

Time (hrs)	Conc. (g/l)	Log10 conc. (g/l)	% of initial
0	5.04 x 10-2	-1.30	-
22	4.35 x 10-2	-1.36	86.4
49	3.76 x 10-2	-1.42	74.8
73	3.18 x 10-2	-1.50	63.2
120	2.71 x 10-2	-1.57	53.8

Result: Slope = -2.27 x 10-3
kobs = 5.23 x 10-3 hour-1 = 1.45 x 10-6 second-1
t½ = 133 hours

pH 9 at 30.0 ± 0.5ºC

Time (hrs)	Conc. (g/l)	Log10 conc. (g/l)	% of initial
0	5.07 x 10-2	-1.30	-
2	4.80 x 10-2	-1.32	94.5
6	4.40 x 10-2	-1.36	86.8
24.5	3.10 x 10-2	-1.51	61.1
48.0	1.99 x 10-2	-1.70	39.3

Result: Slope = -8.36 x 10-3
kobs = 1.92 x 10-2 hour-1 = 5.35 x 10-6 second-1
t½ = 36.0 hours

pH 9 Arrhenius Data

T (ºC)	20	30
T (K)	293	303
1/T(K)	3.41 x 10-3	3.30 x 10-3
1 kobs (hr-1)	5.23 x 10-3	1.92 x 10-2
Ln kobs	-5.25	-3.95

From the graph of above data, the rate constant and half-life at 25°C have been estimated to be as follows:
kobs = 1.01 x 10-2 hour-1 = 2.82 x 10-6 second-1
t½ = 68.4 hours

Validation: The linearity of the detector response with respect to concentration was assessed over the nominal concentration range of 0 to 1.5 mg/l for pH 4, 7 and 9 solutions. This was satisfactory with a minimum correlation coefficient of 0.999 being obtained.

Discussion: The kinetics of the study have been determined to be consistent with that of a pseudo-first order reaction as the graphs of log10 concentration versus time are straight lines. It has been observed that the rate of hydrolysis increases with an increase in pH.

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint
14.12.2005

(16)

3.1.3 STABILITY IN SOIL

3.2 MONITORING DATA

3.3.1 TRANSPORT BETWEEN ENVIRONMENTAL COMPARTMENTS

Type : volatility
Media : water - air
Air (level I) : .23
Water (level I) : 46.7
Soil (level I) : 52.9
Method : other
Year : 2001
GLP : not applicable
Test substance : as prescribed by 1.1 – 1.4
Method : The EPIWIN Program was used to perform Level III fugacity modeling. Inputs to the model were the molecular weight, aqueous solubility, vapor pressure, Kow and log Kow, Henry's Law Constant from Henry (v3.10), a temperature of 25 degrees C, a calculated air-water partition coefficient and a biomass to water partition coefficient. Biodegradation rate constants were calculated based on the properties of the modeled compound. An STP overall chemical mass balance was calculated. Outputs of the model are the mass percentage in each environmental compartment, half-lives in each compartment and emission rates from these compartments.

Remark : A Henry's Law Constant of 1.86E-007 was calculated using the Henry (v3.10) Program and the bond estimate method, based on the sum of the contributions of individual molecular fragments. A mass amount of 0.115% is estimated for sediment using the EPIWIN fugacity Level III model.

Reliability : (2) valid with restrictions. Data were obtained by modeling.
11.09.2001

3.3.2 DISTRIBUTION

3.4 MODE OF DEGRADATION IN ACTUAL USE

3.5 BIODEGRADATION

Type	:	aerobic
Result	:	readily biodegradable
Method	:	OECD Guideline 301 D "Ready Biodegradability: Closed Bottle Test"
Year	:	1994
GLP	:	yes
Test substance	:	as prescribed by 1.1 – 1.4
Result	:	The average COD of the test material was 1.147 mg oxygen/mg. The average BOD on days 7, 14, 21 and 28 was 0.055, 0.11, 0.540 and 0.84 mg oxygen/mg. The biodegradability of the test material on days 7, 14, 21 and 28 was 4.4, 9.6, 47 and 73.2%, respectively. The biodegradability of the positive control material (sodium acetate) at the same time points was 67.3, 73.1, 88.4 and 97%, respectively. The dissolved oxygen values of the test material plus sodium acetate were lower at days 7 and 14 than those of sodium acetate, indicating that the test material did not have a significant inhibitory effect on the bacterial inoculum.
Test condition	:	COD: The COD test was performed in accordance with ISO 6060-1986(E). A 4% (w/v) solution of test material in methylene chloride was prepared. Twenty-five microliters of this solution were transferred to COD test tubes and the solvent was evaporated to dryness. Twenty ml of distilled water were added to obtain a final concentration of 50 mg/l. A blank test was carried out by evaporating 25 microliters of methylene chloride to dryness in COD tubes and adding 20 ml distilled water. After 110 minutes of reflux the excess dichromate was titrated with ammonium iron (II) sulphate using ferroin as the indicator. The COD (mg oxygen/mg test substance) was
Test condition	:	calculated as (b-a) Nred x 400 / mg test article/l, where a and b are the volumes (ml) of ammonium iron (II) sulphate used to titrate the test article and blank, respectively; and Nred is the normality of the ammonium iron (II) sulphate solution. BOD: The BOD test was performed in accordance with OECD 301D and with EEC Directive 92/32. A 4% (w/v) solution of test material in methylene chloride was prepared. Sixteen microliters of this solution (or methylene chloride blank; negative control) were transferred BOD bottles (315 ml) and the solvent was evaporated to dryness. Fully aerated mineral medium was added so the final test material concentration was 2 mg/l. The test article and positive control (sodium acetate, 2 mg/l) were tested also together to determine if the test article inhibited BOD. All tests were performed in duplicate. Tubes were inoculated with microorganisms from a mixed population (number was determined, but not stated) and kept in closed bottles in the dark at 20 +/- 1 degrees C. The concentration of dissolved oxygen was calculated by the Winkler method at immediately (negative control only), 7, 14, 21 and 28 days. The BOD was calculated as mg O2 uptake of test article – blank/ mg of test article/liter. Biodegradability was calculated as BOD/COD x 100.
Reliability	:	(2) valid with restrictions. The number of bacteria used and test material purity were not stated.

11.09.2001 (18)

3.6 BOD5, COD OR BOD5/COD RATIO

3.7 BIOACCUMULATION

3.8 ADDITIONAL REMARKS

4.1 ACUTE/PROLONGED TOXICITY TO FISH

Type	:	static
Species	:	Lepomis macrochirus (Fish, fresh water)
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no
NOEC	:	.22
LC50	:	.57
Method	:	other
Year	:	1982
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Remark	:	The low oxygen saturation did not appear to adversely affect the fish, as all controls survived.
Result	:	All fish exposed to 1.7 mg/l test material died within 24 hours. Fish exposed to 1.0 mg/l had a 30% mortality rate at 24 hours. All fish exposed to this concentration died by 48 hours. Fish exposed to 0.6 mg/l had a mortality rate of 30% at 72 hours, and 40% at 96 hours. Ten percent of fish exposed to 0.36 mg/l died by 48 hours. No additional mortality was observed at this dose over the remainder of the test. None of the controls or fish exposed to 0.22 mg/l died. The NOEL through 96 hours was 0.22 mg/l. The 24- and 48-hour LC50 and CI were estimated by binomial probability to be 1.0 (0.6-1.7) and 0.77(0.6-1.0) mg/l, respectively. The 72- and 96-hour LC50 and CI were estimated by moving average angle analysis to be 0.6 (0.47-0.76) and 0.57(0.45-0.73), respectively.
Test condition	:	Fish were held in a 500 liter fiberglass tank under a photoperiod of 16 hours light and 8 hours darkness for 14 days and were fed daily (except for 48 hours prior to testing). The water in the holding tank had a total hardness and alkalinity range as calcium carbonate of 22-26 mg/l and 16-24 mg/l, respectively, a specific conductance range of 90-110 micromhos/cm, a pH range of 6.9-7.2, a dissolved oxygen concentration of >100% saturation, a temperature of 22-23 degrees C, and a flow rate of 10-12 tank volume replacements/day. A stock solution of 1.5 mg/ml test material was prepared by diluting 0.15 grams of test material with 100 ml deionized water. The solution was added to test vessels (19.6 liter glass jars) in volumes sufficient to give final test concentrations of 0 (control), 0.22. 0.36, 0.60, 1.0 and 1.7 mg/l in a total of 15 liters of reconstituted water. They were not aerated. Ten bluegill with a mean wet weight and total length of 0.26 (0.14 to 0.45) grams and 29 (24-35) millimeters were randomly distributed to each test jar within 30 minutes of test solution preparation. Fish were not fed during exposure. The pH and dissolved oxygen was measured at 0, 24, 48 and 96 hours in the control and 0.22, 0.60 and 1.7 mg/l vessels. The temperature was measured in the control vessel at 0, 24, 48, 72, and 96 hours of exposure. The physical condition of the fish and test solutions in all flasks was also determined at these time points. A computer program was used to calculate the LC50 value and confidence intervals (CI) at 24, 48, 72 and 96 hours.
Test substance	:	Test material contained 100% active ingredient.
Reliability	:	(2) valid with restrictions. The study passed a QA audit. Concentrations of test material were not verified analytically.

17.10.2001

(23)

Type	:	static
Species	:	Cyprinodon variegatus (Fish, estuary, marine)
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no
NOEC	:	.5
LC50	:	.707
LC100	:	1
Method	:	other
Year	:	1982
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Remark	:	Both the dissolved oxygen concentration and pH range were considered acceptable throughout the test.
Result	:	There was 60% and 100% mortality in fish exposed to 2.0 mg/l by 24 and 48 hours, respectively. There was 55% and 100% mortality in fish exposed to 1.0 mg for 48 and 72 hours, respectively. Fish exposed to the other concentrations lived for the duration of the test. The NOEL through 96 hours was 0.50 mg/l. The 24-, 48-, 72- and 96-hour LC50 and CI were estimated by moving average angle analysis to be 1.84 (1.8-1.87) and 0.976(0.620-1.01), 0.707(0.384-0.713), and 0.707 (0.384-0.713) mg/l, respectively.
Test condition	:	Sheepshead minnows (16-18 days old) were born at the testing site and maintained for 96 hours before testing. During holding, temperature was maintained at 22 +/- 1 degrees C and salinity at 24-28 parts per thousand. Test water was filtered natural seawater that was pumped from Big Lagoon, a Gulf of Mexico estuary adjacent to the testing site. Initial pH and dissolved oxygen concentration (DO) were 8.0-8.1 and >= 93% of saturation, respectively. A stock solution of test material was prepared by diluting 0.25 grams of test material up to 200 ml with triethylene glycol. For each test concentration (0.125, 0.25, 0.5, 1.0 and 2.0 mg/l), the appropriate volume of this stock solution was added to the appropriate volume of seawater to total 3 liters. A vessel containing the highest amount of triethylene glycol used to dilute the test material (4.8 ml) also was prepared. Tests were conducted in 13.8-liter covered glass jars, each of which contained a final volume of 3.0 liters of test solution, vehicle solution or control seawater. Ten fish were placed in each jar, and treatments were duplicated. Test water was not aerated and fish were not fed during the test. Lethality was determined at 24, 48, 72 and 96 hours. A computer program was used to calculate the LC50 value and confidence intervals (CI) at 72 and 96 hours.
Reliability	:	(2) valid with restrictions. The study passed a QA audit. Purity of test material was not noted. Concentrations of test material were not verified analytically.

17.10.2001 (28)

4.2 ACUTE TOXICITY TO AQUATIC INVERTEBRATES

Type	:	static
Species	:	Daphnia magna (Crustacea)
Exposure period	:	48 hour(s)

Unit	:	mg/l
Analytical monitoring	:	no
NOEC	:	11
EC50	:	18
Method	:	other
Year	:	1982
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	Concentrations of 30 and 50 mg/l caused 100% lethality by 24 hours. A concentration of 18 mg/l caused 20%, 0% and 80% mortality in each of the flasks by 48 hours (average 33%). The 24- and 48-hour LC50 and CI were estimated by binomial probability to be 23 (18-30) and 18 (11-30) mg/l, respectively. The no discernable effect concentration through 48 hours was 11 mg/l.
Test condition	:	A stock solution of 1.0 mg/ml test material was prepared by diluting 0.10 grams of test material with 100 ml distilled water that had been filtered to remove any potential organic contaminants (dilution water). For each test concentration (6.4, 11, 18, 30 and 50 mg/l), the appropriate volume of this stock solution was added to the appropriate volume of dilution water to total 500 ml. Three control beakers containing 150 ml of dilution water were also prepared. Test solutions were maintained at 22 +/-/1 degrees C. They were not aerated. The test area was illuminated with fluorescent lights at an intensity of 430-760 lux. Five water fleas (<= 24 hours old) were randomly distributed into each test beaker within 30 minutes of test solution preparation. Mortalities, and condition of fleas and water were recorded after 24 and 48 hours of exposure. The water hardness, alkalinity and specific conductance were measured prior to testing. The pH and dissolved oxygen was measured at 0 and 48 hours in one flask from each test concentration (and control). The temperature was measured at 0 and 48 hours in another flask from each dose group. A computer program was used to calculate the LC50 value and confidence intervals (CI) at 24 and 48 hours.
Reliability	:	(2) valid with restrictions. The study passed a QA audit. Purity of test material was not noted. Concentrations of test material were not verified analytically.

17.10.2001 (26)

Type	:	static
Species	:	Mysidopsis bahia (Crustacea)
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no
EC50	:	70.7
Method	:	other
Year	:	1982
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	Exposure to the solvent alone induced 5% mortality by 24 hours. Exposure to 6.25 or 12.5 ppm did not cause lethality. Exposure to 25.0 ppm induced 5% mortality by 24 hours, and 15% by 48 hours. Exposure to 50 ppm caused 10% lethality at 24 hours, 20% mortality at 48 and 72 hours, and 30% mortality at 96 hours. Exposure to 100 ppm caused 0% mortality at 24 hours, 40% at 48 hours, 60% at 72 hours, and 70% at 96 hours.

The LC50 values and CIs (calculated by the moving average angle method) were > 100 ppm for 24 and 48 hours, 84.7 (81.4-88.2) ppm for 72 hours, and 70.7 (55.6 - 77.6) ppm for 96 hours.

Test condition : Test shrimp were born at the testing site and maintained for 3 days before testing. During holding, temperature was maintained at 22 +/- 1 degrees C and salinity at 20 parts per thousand. Test water was natural seawater that was pumped from Big Lagoon, a Gulf of Mexico estuary adjacent to the testing site. Seawater was diluted with freshwater to 20 parts per thousand salinity, aerated, filtered (5 micrometers), and distributed into test chambers. Initial pH and dissolved oxygen concentration (DO) were 8.0-8.1 and >= 93% of saturation, respectively.

A stock solution of test material was made by dissolving 2.52 g of material in 200 ml of triethylene glycol. Test concentrations (6.25, 12.5, 25, 50 and 100 ppm) were made by adding appropriate volumes of stock material to each container.

Tests were conducted in 1.6-liter covered glass bowls, each of which contained a final volume of 1.0 liter of test solution or control seawater. Ten shrimp were placed in each bowl, and treatments were duplicated. Ten shrimp were also exposed in duplicate to a solvent control of the highest volume of triethylene glycol added to any bowl (8 ml). Test water was not aerated during test. Lethality was determined at 24, 48, 72 and 96 hours.

A computer program was used to calculate the LC50 value and confidence intervals (CI) at 72 and 96 hours.

Reliability : (2) valid with restrictions. The study passed a QA audit. Purity of test material was not noted. Concentrations of test material were not verified analytically.

17.10.2001 (27)

4.3 TOXICITY TO AQUATIC PLANTS E.G. ALGAE

Species	:	Selenastrum capricornutum (Algae)
Endpoint	:	other: change in cell numbers
Exposure period	:	96 hour(s)
Unit	:	mg/l
Analytical monitoring	:	no
NOEC	:	10
Method	:	other
Year	:	1983
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	The number of cells in the growth medium control flasks underwent a 14% decrease (with respect to the solvent control). Algae incubated with all concentrations of test material exhibited 5 to 10% decreases in cell number (with respect to the solvent control). There was no concentration-dependent decrease in cell number. The lowest concentration (0.625 mg/l) caused the biggest decrease (10%).

There was no concentration-dependent effect of test material on chlorophyll a fluorescence. At 2.5 mg/l, test material induced a 35% increase in fluorescence with respect to the solvent control. All other treatments induced anywhere from a 12% decrease (0.625 mg/l) to a 9% increase (1.25 mg/l). There was a 7% decrease in fluorescence among algae treated with growth medium versus the solvent control.

Test condition : A primary stock solution of test material was prepared by adding 0.87 ml of material to 100 ml triethylene glycol (solvent). Additional stocks were prepared by serially diluting the stock solutions to concentrations that provided test concentrations of 0.625, 1.25, 2.5, 5.0 and 10.0 mg/l when 0.05 ml of the stocks were added to test flasks. Concentrations of greater than 10.0 mg/l caused test material precipitation in test flasks.

Freshwater algae (6 days old) were added to test flasks at approximately 2.0 x 10E4 cells/ml. The composition of the test medium was referred to as "algal assay procedure medium". Three replicates were employed for each of the test concentrations and controls (medium and solvent control). The solvent control received 0.05 ml of triethylene glycol (1000 mg/ml). Previous tests had shown that this was the maximum amount of solvent that would not produce toxicity. Cultures were incubated at 24 +/- 1 degrees Celsius under constant illumination of approximately 4500 lux for 96 hours. They were shaken at 100 rpm. In vivo chlorophyll content was measured each day with a fluorimeter. Cells were counted at the end of the test using a hemacytometer and compound microscope. Initial and final pH was recorded.

Reliability : (2) valid with restrictions. The study passed a QA audit. Purity of test material was not noted. Concentrations of test material were not verified analytically.

17.10.2001 (13)

Species : Skeletonema costatum (Algae)
Endpoint : other: change in cell number
Exposure period : 96 hour(s)
Unit : µl/l
Analytical monitoring : no
NOEC : 10 (11.43 mg/l)
Method : other
Year : 1983
GLP : no data
Test substance : as prescribed by 1.1 - 1.4
Remark : Using a density of 1.143 g/cm3, test concentrations can be converted to mg/l. Test concentrations of 0.312, 0.625, 1.25, 2.5, 5.0 and 10.0 microliters/l are therefore 0.357, 0.714, 1.43, 2.86, 5.72, and 11.43 mg/l, respectively.

Result : There was no change in cell number of the growth medium control (with respect to the solvent control). There was no concentration-dependent decrease in cell number. Algae incubated with all concentrations of test material exhibited 0 (0.625 and 1.25 microliters/l) to 15% (5.0 microliters/l) decreases in cell number (with respect to the solvent control). The highest concentration tested (10 microliters/l) caused a 7% decrease.

There was no concentration-dependent effect of test material on chlorophyll fluorescence. Treatments induced anywhere from a 21% decrease (2.5 microliters/l) to a 9% increase (1.25 microliters/l). The highest concentrations tested (5 and 10 microliters/l) caused 9 and 5% decreases, respectively. There was a 14% increase in chlorophyll fluorescence treated with growth medium versus the solvent control.

Test condition : A primary stock solution of test material was prepared by adding 0.87 microliters of material to 100 ml triethylene glycol. Additional stocks were prepared by serially diluting the stock solutions to concentrations that provided test concentrations of 0.312, 0.625, 1.25, 2.5, 5.0 and 10.0 microliters/l (ppm) when 0.05 ml of the stocks were added to test flasks. Concentrations of greater than 10.0 ppm caused test material precipitation

in test flasks.

Saltwater algae from the USEPA, Gulf Breeze, Florida (5 days old) were added to test flasks at approximately 2.0 x 10E4 cells/ml. Test medium was artificial seawater adjusted to a salinity of 30 parts per thousand and enriched with nutrients. Three replicates were employed for each of the test concentrations and controls (medium and solvent control). The solvent control received 0.05 ml of triethylene glycol (1000 mg/ml). Previous tests had shown that this was the maximum amount of solvent that would not produce toxicity. Cultures were incubated at 20 degrees Celsius under constant illumination of approximately 4300 lux for 96 hours. They were shaken at 100 rpm. In vivo chlorophyll content was measured each day with a fluorimeter. Cells were counted at the end of the test using a hemacytometer and compound microscope. Initial and final pH was recorded.

Reliability : (2) valid with restrictions. The study passed a QA audit. Purity of test material was not noted. Concentrations of test material were not verified analytically.

17.10.2001 (14)

4.4 TOXICITY TO MICROORGANISMS E.G. BACTERIA

4.5.1 CHRONIC TOXICITY TO FISH

4.5.2 CHRONIC TOXICITY TO AQUATIC INVERTEBRATE

4.6.1 TOXICITY TO SOIL DWELLING ORGANISMS

4.6.2 TOXICITY TO TERRESTRIAL PLANTS

4.6.3 TOXICITY TO OTHER NON-MAMM. TERRESTRIAL SPECIES

4.7 BIOLOGICAL EFFECTS MONITORING

4.8 BIOTRANSFORMATION AND KINETICS

4.9 ADDITIONAL REMARKS

5.1.1 ACUTE ORAL TOXICITY

Type	:	LD50
Species	:	rat
Strain	:	Fischer 344
Sex	:	male/female
Number of animals	:	40
Value	:	= 515 mg/kg bw
Method	:	other
Year	:	1981
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	All animals dosed with 800 mg/kg died within 3 days. One male and all five females treated with 600 mg/kg died within 1 day. Two females treated with 400 mg/kg died within 2 days. No animals treated with 100 mg/kg died. The LD50 was 416 mg/kg for males, between 400 and 600 mg/kg for females, and 515 mg/kg for both sexes.
Test condition	:	Twenty male and twenty female rats (174 to 251 g) were divided into 4 groups of 5 per sex and were dosed into the stomach with 100, 400, 600 or 800 mg/kg test material in corn oil. Dosing solutions contained 0.75%, 3.00%, 4.50%, and 6.00% test material. Dose volumes of 1.33 ml/kg were given to all rats. Animals were observed twice daily for 14 days for signs of toxicity and mortality. Animals were weighed the day before dosing, the day of dosing, and 7 and 13 days following dosing. Necropsies were performed on all animals upon death or 14 days after dosing. LD50 values were calculated based on the method of Litchfield and Wilcoxon.
Test substance	:	The test material was identified as diallyl diglycol carbonate by the manufacturer (PPG Industries, Inc).
Reliability	:	(1) valid without restriction
17.10.2001		(6)

Type	:	LD50
Species	:	rat
Strain	:	other: Charles River
Sex	:	male/female
Number of animals	:	20
Value	:	= 349.4 mg/kg bw
Method	:	other
Year	:	1971
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	Two out of 4 rats administered 266.7 or 400 mg/kg, and three out of four given 600 mg/kg died within 3 days. All animals given 900 mg/kg died within 2 days. Animals that died exhibited pale livers and hemorrhage in the gastrointestinal tract. No gross alterations were noted in survivors. The LD50 value was 349.4 (+/- 84.11) mg/kg.
Test condition	:	Rats (150-216 g) were observed for 5 days prior to treatment. Groups of 4 rats (2 of each sex) were given 177.8, 266.7, 400, 600, or 900 mg/kg test material by gavage. All doses except the high dose were administered as a 10% (w/v) solution in corn oil. The high dose was administered undiluted. Animals were then individually housed and observed for 14 days. Initial and final body weights, mortalities, reactions, and deaths were recorded. Necropsies were conducted on all animals. The LD50 value was calculated using the moving average method of Weil and Thompson.

Reliability : (2) valid with restrictions. Purity of test material was not noted. Fewer than 5 animals were tested per dose.

17.10.2001 (2)

5.1.2 ACUTE INHALATION TOXICITY

5.1.3 ACUTE DERMAL TOXICITY

Type	:	LD50
Species	:	rabbit
Strain	:	New Zealand white
Sex	:	male/female
Number of animals	:	8
Value	:	> 10 mg/kg bw
Method	:	other
Year	:	1981
GLP	:	yes
Test substance	:	other TS
Result	:	Three females were found dead on day 2 of the study. Two of the animals that died exhibited signs of hemorrhage. Two survivors had irregular, pale foci on the liver. Slight to moderate erythema and edema were noted during days 1-3. The LD50 was higher than the dose administered because it produced mortality in 3/8 animals.
Test condition	:	Rabbits were observed for 13 days prior to treatment. Back fur was clipped 24 hours before treatment. Eight rabbits (4 per sex, 2.25-2.50 kg) were treated with 10 ml/kg test material. Each test site was occluded with a layer of gauze and the trunk of each rabbit was wrapped with rubber latex dental dam. Each rabbit was maintained in a harness for the 24 hour exposure period (to prevent animals from disturbing the test site).. The wrappings were then removed and the residual test material was wiped off. Animals were examined for skin reactions and mortality for 4 additional days. All animals were weighed one day prior to dosing, on day of dosing, and 6 and 13 days after dosing. Gross necropsies were performed on visceral and thoracic cavities of all survivors.
Test substance	:	Commercial CR-39
Reliability	:	(2) valid with restrictions. Purity of test material was not noted.

17.10.2001 (7)

Type	:	LD50
Species	:	rabbit
Strain	:	New Zealand white
Sex	:	male/female
Number of animals	:	6
Value	:	> 5 ml/kg bw
Method	:	other
Year	:	1981
GLP	:	yes
Test substance	:	other TS
Result	:	One rat had diffuse intermingled pale white to yellow foci on the liver upon necropsy. No deaths occurred. Slight to moderate erythema and edema were noted from days 1-5, slight eschar formation on days 6-13, scaling on days 3-13, and cracking on days 4-7.
Test condition	:	The skin test site was abraded just prior to applying test material. Six

rabbits (4 males, 2 females, 2.30-2.90 kg) were treated with 5 ml/kg test material. Each test site was occluded with a layer of gauze. The trunk of each rabbit was wrapped with rubber latex dental dam. Each rabbit was maintained in a harness for the 24 hour exposure period (to prevent animals from disturbing the test site). The wrappings were then removed and the residual test material was wiped off. Animals were examined for skin reactions and mortality for 13 additional days. All animals were weighed one day prior to dosing, on the day of dosing, and 3, 9, and 13 days after dosing. Gross necropsies were performed on visceral and thoracic cavities of all survivors.

Test substance : Test material was identified as 97.5% diallyl diglycol carbonate plus 2.5% IR absorber.

Reliability : (1) valid without restriction

17.10.2001 (8)

Type : LD50
Species : rabbit
Strain : New Zealand white
Sex : male/female
Number of animals : 8
Value : > 3038 and < 10250 mg/kg
Method : other
Year : 1971
GLP : no data
Test substance : as prescribed by 1.1 - 1.4
Result : One out of 4 animals (female) treated with 3038 kg/kg and 3/4 animals treated with 10250 mg/kg died after 5 days of treatment. No other animals died. Skin irritation characterized by red, well-defined erythema and severe edema was found at the application site 24 hours after test material administration (doses not noted). Dryness was evident after 14 days. No other alterations were noted.

Test condition : Rabbits (2.26 to 3.14 kg) were observed for 7 days prior to testing. Their backs were shaved 24 hours prior to test material administration. Test material was applied at 3038 mg/kg and 10250 mg/kg to two animals per sex. The test site was covered by wrapping the trunk of the animal with impervious plastic sheeting that was taped into place. Each animal was then fitted with a flexible plastic collar. The dressing and residual test material were removed after 24 hours. Animals were observed for mortality, local skin reactions and behavioral abnormalities over the next 14 days. Initial and final body weights were recorded. Necropsies were performed on all animals.

Reliability : (2) valid with restrictions. Purity of the test material was not noted. Fewer than 5 animals were tested per dose.

17.10.2001 (2)

5.1.4 ACUTE TOXICITY, OTHER ROUTES

Type : LD50
Species : mouse
Strain : other: albino
Sex : female
Number of animals : unknown
Route of admin. : i.p.
Exposure time : unknown
Value : = 269 mg/kg bw

Method	:	other
Year	:	1947
GLP	:	no
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	The LD50 was 0.98 millimoles/kg (269 mg/kg). Effects noted were pulmonary edema, acute tubular necrosis, and acute kidney failure.
Test condition	:	Animals (number and dose levels not stated) were observed for up to 7 days following injection.
Reliability	:	(4) not assignable. Not enough information was given in the abstract.

17.10.2001 (5)

5.2.1 SKIN IRRITATION

Species	:	rabbit
Concentration	:	undiluted
Exposure	:	occlusive
Exposure time	:	6 hour(s)
Number of animals	:	6
Result	:	slightly to highly irritating
Method	:	other
Year	:	1979
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	Only two rabbits received scores other than 0 within 7 days of application. Very slight to slight erythema and very slight edema at both sites at the 48-hour reading were noted in one rabbit (rabbit 1) treated with undiluted material. The other rabbit (rabbit 2) exhibited very slight erythema to undiluted material at 24 hours at the abraded site. At 48 hours, moderate to severe erythema were noted at all sites on this rabbit, and by 72 hours irritation progressed to necrosis with severe erythema and very slight edema. Reddened and blackened skin at all test sites of this rabbit were noted on day 5. No visible lesions were present on any other rabbit on day 5. Necrosis and slight edema were noted on the biopsied area of rabbit 1 on day 11 (undiluted material site), and another (rabbit 3) treated with diluted material on days 9 and 11. By 13 days, edema (but not erythema) resolved in rabbit 2.
Test condition	:	Undiluted test material (0.5 ml) was applied at one intact and one abraded site on rabbits (3/sex), and test material diluted with 0.2 ml of sterile physiological saline was applied to the other intact and abraded sites. The test material was applied under a surgical gauze patch. The trunk of each animal was then wrapped with rubber dental damming. An outer layer of gauze and tape was placed around the trunk of each animal and the animals were placed in harnesses (to prevent animals from disturbing the test site). After 6 hours, the patches were removed and any residual sample was gently removed with a moistened towel. Reactions were scored immediately after removal (6 hour reading), and at 24, 28, and 72 hours, and on days 7, 9, 11, and 13. Because of unusual lesions in some animals, a veterinary pathologist removed biopsies for histopathologic examination on day 5.
Test substance	:	Samples of test material were analyzed by chromatography for impurities. One sample of test material contained 42.5 ppm acrolein, 28.2 ppm allyl alcohol and 2399 ppm diallyl carbonate before test initiation, and 42.0 ppm acrolein, 27.4 ppm allyl alcohol and 1499 ppm diallyl carbonate after the

test was concluded. A different sample that was used contained 22 ppm acrolein, 19 ppm allyl alcohol and 2789 ppm diallyl carbonate before test initiation (this sample was not tested again).

Reliability : (1) valid without restriction

25.10.2001 (19)

Species	:	Rabbit
Concentration	:	Undiluted
Exposure	:	Occlusive
Exposure time	:	24 hour(s)
Number of animals	:	4
Result	:	highly irritating
Method	:	other:Draize
Year	:	1971
GLP	:	no data
Test substance	:	as prescribed by 1.1 - 1.4
Result	:	In 3/4 rabbits, both abraded and non-abraded sites had scores of 4 for both erythema and edema at 24 and 72 hours (beet or crimson red erythema and swelling of more than 1 mm). Superficial burns were noted in 2 of these animals at both time points. Erythema and edema were not as severe in one animal (scores of 2 and 1). The average primary irritation score was 6.8 (extremely irritating).
Test condition	:	Test material was applied to the shaved back and flanks of four rabbits at two test sites located lateral to the midline of the back (approximately 10 cm apart). One of the two sites was abraded. Undiluted test material (0.5 ml) was applied to each test site. Gauze was placed over the test material and secured with masking tape. The trunk of each animal was then wrapped with impervious plastic sheeting. To prevent ingestion, a lightweight, flexible collar was placed on each animal. The collar, wrappings and gauze were removed after 24 hours. Test sites were examined and scored separately for erythema and edema on a graded scale of 0 to 4. Sites were reexamined and scored after 72 hours. Mean scores for edema and erythema at both time points were added together and divided by 4 to obtain the mean primary irritation score.
Reliability	:	(2) valid with restrictions. Purity of the test material was not noted.

17.10.2001 (2)

Species	:	Rabbit
Concentration	:	Undiluted
Exposure	:	Occlusive
Exposure time	:	24 hour(s)
Number of animals	:	Unknown
PCII	:	0.7
Result	:	Slightly irritating
Method	:	Draize Test
Year	:	1976
GLP	:	No
Test substance	:	As prescribed by 1.1 - 1.4
Remark	:	Results of studies with humans were also described in this reference. They are described in Section 5.11.
Result	:	Application of any product provoked only minimal changes in the skin after 24 hours (slight erythema in some animals). The PCII scores of undiluted French samples, American samples, and pure samples and the diluted French sample were 0.5, 0.4, 0.7 and 0.1, respectively (out of a scale of 8). Total recovery was achieved by the 6th day.

Test condition	:	Groups of female New Zealand rabbits (2.6 to 3.2 g) were treated with undiluted CR 39 (industrial samples from America and France, and purified product), or the French sample diluted to 10% in dimethyl sulfoxide. The number of rabbits in each group was not listed. Pads of sterile gauze and cotton impregnated with 0.5 ml of the product were placed on intact or scarified skin. Pads were held in place for 24 hours with waterproof adhesive tape. Skin was scored at 24, 48 and 72 hours. The Primary Cutaneous Irritation Index (PCII) at 24 and 72 hours was calculated according to the method of Draize.
Conclusion	:	The irritant effect of diallyl glycol carbonate appears to be greater in man than the rabbit.
Reliability	:	(2) valid with restrictions. The number of animals in each group and the purity of the test material were not listed.

17.10.2001 (9)

5.2.2 EYE IRRITATION

Species	:	Rabbit
Concentration	:	undiluted
Dose	:	0.1 ml
Exposure Time	:	168 hour(s)
Number of animals	:	5
Result	:	Slightly irritating
Method	:	Other: Draize
Year	:	1971
GLP	:	No data
Test substance	:	As prescribed by 1.1 - 1.4
Result	:	The only tissue affected was the conjunctiva. Conjuctival redness and slight discharge resolved by 24-72 hours. An irritation score of 6.4/1100 (minimal irritation) was obtained (average discharge score (1.2) + chemosis score (0) + average redness score (2) x 2).
Test condition	:	Test material (0.1 ml, undiluted) was instilled into the conjunctival sac of the right eye of each of five rabbits. The cornea, iris, and palpebral conjunctiva were examined and graded for irritation and injury according to a standard scoring system at (which placed more emphasis on irritation and damage to the cornea than the other tissues) 1 minute, 1, 24 and 72 hours, and 7 days after test material administration. Test material was not washed from eyes.
Reliability	:	(2) valid with restrictions. Purity of the test material was not noted.

17.10.2001 (2)

5.3 SENSITIZATION

Type	:	Patch-Test
Species	:	Rabbit
Number of animals	:	6
Result	:	Not sensitizing
Classification	:	Not sensitizing
Method	:	Other
Year	:	1979
GLP	:	No data
Test substance	:	As prescribed by 1.1 - 1.4
Remark	:	Results of the first phase of this study are reported under heading 5.1.
Result	:	Test material caused sporadic irritation with necrosis. Tissue sent for

examination showed no evidence of deposits of IgG in arterial walls. Therefore, irritation was not caused by an IgG-related immune response.

Test condition : Rabbits (3/sex, 1.86 to 2.16 kg) were acclimated for 6 days prior to study initiation. Four application sites were prepared on each rabbit by clipping the hair from the saddle area of the rabbits. Undiluted test material (0.5 ml) was applied at one intact and one abraded site. Test material diluted with 0.2 ml of sterile physiological saline was applied to the other intact and abraded sites.

The test material was applied under a surgical gauze patch. The trunk of each animal was then wrapped with rubber dental damming. An outer layer of gauze and tape was placed around the trunk of each animal, and then the animals were maintained in a harness for 6 hours (to prevent animals from disturbing the test site). After 6 hours, the patches were removed and any residual sample was gently removed with a moistened towel. Reactions were scored immediately after removal (6 hour reading), and at 24, 28, and 72 hours, and on days 7, 9, 11, and 13.
Twenty-six days following the initial application of test material, the abdomens of each of the six rabbits were clipped. Test material (0.5 ml) was then applied to the center of the shaved area (as previously described). In one rabbit that was severely affected by the first application, 25 microliters of test material was applied to another test site anterior to the central site. The sites were left intact, and the binding materials and harnesses were used as described previously.

After 6 hours, the patches were removed and any residual sample was sponged from the skin with a moistened towel. Reactions were scored immediately after removal (6 hour reading), and at 24, 28, and 72 hours.

A third trial was performed 21-days after the second application of test material. A different batch of sample was used for this test. The abdomens of the six rabbits were shaved again, and two application sites (lateral to the ventral longitudinal midline of the rabbit) were prepared. One patch site on each rabbit was left intact, and one site was abraded. The gauze patches, binding materials and harnesses were used as described previously.

After 6 hours, the patches were removed and any residual sample was sponged from the skin with a moistened towel. Reactions were scored immediately after removal (6 hour reading), and at 24, 28, and 72 hours, and at 7 days. Selected biopsies were taken for histopathologic and immunofluorescent examination

Test substance : Samples of test material were analyzed by chromatography for impurities. One sample of test material contained 42.5 ppm acrolein, 28.2 ppm allyl alcohol and 2399 ppm diallyl carbonate before test initiation, and 42.0 ppm acrolein, 27.4 ppm allyl alcohol and 1499 ppm diallyl carbonate after the test was concluded. A different sample that was used contained 22 ppm acrolein, 19 ppm allyl alcohol and 2789 ppm diallyl carbonate before test initiation (this sample was not tested again).

Conclusion : Treatment with test material resulted in sporadic irritation with necrosis. The response was not immune-related and the material was not determined to be a sensitizer.

Reliability : (1) valid without restriction
25.10.2001

(19)

Type : Patch-Test
Species : Guinea pig
Number of animals : 30

Result	:	Not sensitizing
Classification	:	Not sensitizing
Method	:	Other: Buehler (Arch Dermat. 91: 171-5, 1965)
Year	:	1979
GLP	:	No
Test substance	:	As prescribed by 1.1 - 1.4
Result	:	Slight, patchy erythema was noted in 1/4 guinea pigs treated with undiluted CR-39 monomer during the preliminary primary irritation test. The irritation scores of the other 3 guinea pigs treated with undiluted material were 0. All other concentrations of material tested also resulted in irritation scores of 0. Based on these results, the test material was administered undiluted for the challenge test. During the primary challenge of CR-39 monomer, all 20 test animals received irritation scores of 0 at the 24-hour and 48-hour readings. Control animals also received scores of zero.
Test condition	:	Twenty Hartley guinea pigs (10 per sex) served as test animals and 10 (5 per sex) served as controls. They were acclimated for 4 days before treatment. The upper left quadrant of the backs of the guinea pigs was clipped using electric clippers. On the following day, a atch moistened with 0.4 ml of undiluted CR-39 monomer was applied to the shaved area. The trunk of each animal was then wrapped with rubber dental damming, and animals were placed in harnesses (to prevent animals from disturbing the test site). Patches were removed after an exposure period of 6 hours and animals were returned to their cages. The patches were reapplied to the same site of test animals once/week for a total of 3 applications. The same site was shaved the day before each application was made. A new vial of CR-39 monomer was used for each application. After a 2-week rest period, a fresh application site for primary challenge was prepared on the lower left quadrant of the backs of the guinea pigs. On the following day, a challenge patch (treated with 0.4 ml undiluted CR-39 monomer) was applied to all animals (including controls) using the technique previously described. On the next day, the sites were depilated and scored within 2-3 hours (24-hour reading). The sites were scored again after 48 hours (without additional depilation)
Test substance	:	Samples of test material were analyzed by chromatography for impurities. One sample tested prior to application contained 42.5 ppm acrolein, 28.2 ppm allyl alcohol, and 2399 ppm diallyl carbonate. This same sample was reanalyzed after testing and contained 42.0 ppm acrolein, 27.4 ppm allyl alcohol and 1499 ppm diallyl carbonate. An additional sample analyzed prior to testing contained 22 ppm acrolein, 19 ppm allyl alcohol, and 2789 ppm diallyl carbonate (this sample was not tested again).
Reliability	:	(1) valid without restriction

25.10.2001

(4)

5.4 REPEATED DOSE TOXICITY

Type	:	Sub-acute
Species	:	rat
Sex	:	male/female
Strain	:	Sprague-Dawley
Route of admin.	:	dermal
Exposure period	:	42 days
Frequency of treatm.	:	daily, for 6 hours/day

Post exposure period	:	no
Doses	:	150, 454, and 1030 mg/kg/day
Control group	:	other: yes, concurrent with saline
NOAEL	:	= 1030 mg/kg bw
Method	:	other: OECD 422
Year	:	2005
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4

Method : This study was comprised of two components, a repeat dose toxicity study with neurobehavioral evaluations and a reproduction/developmental toxicity screening study (section 5.8.1). The purpose of the repeat dose toxicity study was to provide information on possible target organ effects and the potential for neurobehavioral effects arising from repeated exposures. Both the repeat dose and the reproductive/developmental components were comprised of three treatment groups and a saline-treated control group. Each repeat dose group contained ten male and ten female Sprague-Dawley rats. The ten male animals of each repeat dose group were utilized for the reproductive/developmental component of the study. The test article was administered dermally once daily via occlusion for 6 hours. An anterior and posterior site on the back was shaved and dosing was alternated between the two sites daily. Six hours after test article administration, the occlusive cover was removed, and the site was washed, rinsed and blotted dry. Dose levels were 150, 454, and 1030 mg/kg/day and to achieve these dose levels, the neat test article was administered at respective dose volumes of 0.13, 0.4, and 0.9 ml/kg. The dose volumes were derived on the basis of the density of the test article, 1.143 grams/ml. Females and males in the repeat dose component were treated for at least 42 days. The control animals received 0.9% sodium chloride, USP, at a volume of 0.9 mg/kg for the same duration as the treated animals.

All rats were observed twice daily for morbidity, mortality, and signs of injury. Observations of the animals included clinical signs, neurobehavioral observations (conducted once prior to initiation of test or control article administration and weekly during the study), dermal evaluation (daily for the first 20 days, and weekly for the remainder of the study for erythema and edema according to Draize scale), body weights (at initiation, weekly and at test termination), and food consumption (recorded weekly, except during mating period). Evaluations for motor activity and emotionality, and other behavioral observations, including auditory response, grip strength, pupil reflex, and corneal reflex, were conducted pretest and prior to scheduled terminal euthanasia (after seven weeks of treatment). Blood collections of clinical pathology evaluations were conducted at study termination. Complete necropsies were performed on all animals. Selected organs and tissues were collected, weighed, and preserved. Organs and tissues from control and high-dose animals in the repeat dose component were examined microscopically. In addition, nervous system tissue from female animals from the mid and high repeat dose groups (454 and 1030 mg/kg/day, respectively) as well as the controls were further processed with special neuropathology staining to allow for better examination of possible nervous system effects.

Statistical analysis methods included Levene's Test, Dunnett's Test, Group Pair-wise Comparisons, and Fishers's Exact Test.

Result : No effect of treatment was evident from mortality, clinical evaluations, neurobehavioral evaluations, dermal evaluations, body weights, food consumption, hematological evaluations, serum clinical chemistry, organ

weights, macroscopic, or microscopic evaluations.

Conclusion : The No-Observable-Adverse-Effect Level (NOAEL) of the test article diallyl diglycol carbonate, for systemic toxicity was 1030 mg/kg/day, the highest dose level evaluated.

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

19.12.2005 (22)

Species	:	rat
Sex	:	male/female
Strain	:	other: CD Charles River
Route of admin.	:	dermal
Exposure period	:	14 days
Frequency of treatment	:	daily
Post obs. period	:	none
Doses	:	.08, 0.4, 2 ml/kg
Control group	:	yes
NOAEL	:	= .4 ml/kg bw
LOAEL	:	= 2 ml/kg bw
Method	:	other
Year	:	1980
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4

Remark : As collars were not placed on the animals until after the second day of test material application, and some of the animals slipped out of their collars overnight (numbers not stated), some of the toxicity may have been due to ingestion of the material.

Result : No signs of toxicity or skin irritation were observed in any rats treated with 80 or 400 microliters/kg. Average weight gains of rats treated with 80 microliters/kg were similar to those of 2 control animals fitted with collars (49 g/week). Average weight gains of rats treated with 400 microliters/kg were less than controls during the first week but were similar during the second.

After the second day of application, most of the high dose animals had an accumulation of red material around the nose, eyes and mouth. Test material also appeared to be accumulating at the shaved hairline. After the fifth day of application, food consumption and defecation was reduced in all high dose animals. High dose animals lost an average of 18 g over the first week and gained an average of 19 g from days 7-10. One high dose male died on day 8 of the study. Necropsy revealed extreme emaciation (total lack of fat tissue). The bladder was filled with a coffee-colored liquid, the mucosa of the hindstomach was hyperemic, and some postmortem autolysis had taken place.

The remaining high-dose rats were sacrificed on Day 10 of the study. Necropsies revealed red, caked material around the eyes and external nares, and emaciation. Urinalyses of the 4 male rats revealed ketones (1+) and some protein (1-2+). Cut surfaces of liver and kidneys were unremarkable.

Test condition : Test material was applied to the backs (clipped free of hair) of 5 rats/sex/group (147 - 202 g) at doses of 80, 400 and 2000 microliters/kg for 14 consecutive days. Test material was applied undiluted and spread uniformly over the test area with a glass rod. Small, modified Elizabethan

collars (3.5 to 4 inch circle) were placed on all of the high-dose animals following dosing on the second day to prevent ingestion.

Rats were observed daily for toxicity. Rats were weighed weekly and dose volumes were adjusted accordingly. Terminal body weights were taken at necropsy. Major organs were examined grossly at necropsy. Organs were not examined microscopically. Urine was collected from the bladders of four rats at necropsy and was macroscopically examined for the presence of ketones and protein.

Reliability : (2) valid with restrictions (results at the two lower doses). Results at the high dose are invalid, since not all of the applied material was absorbed. Some of the unabsorbed material is likely to have been ingested.

(15)

Species	:	rat
Sex	:	male/female
Strain	:	other: CD Charles River
Route of admin.	:	dermal
Exposure period	:	14 days
Frequency of treatment	:	twice daily
Post obs. period	:	none
Doses	:	2 ml/kg/day
Control group	:	other: sham
NOAEL	:	< 2 ml/kg bw
Method	:	other
Year	:	1980
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4
Remark	:	Using a density of 1.43 g/cm^3, the test dose can be converted to g/kg/day (2.86).
Result	:	Mean body weights for treated males were significantly less (8.1 to 14.6%) than controls on days 5-9 and 10-14. Food consumption for treated males was lower than control on days 2-5 and 9-12. Water consumption at week 2 was lower in treated females than controls (23.3 vs. 29.4, units not stated but presumed to be ml). There was no effect of treatment on urinalyses or serum chemistries. Brownish coloration of the shaved hair area, red encrustation around the eyelids and the general absence of fatty tissue were noted in 4/5 treated rats at necropsy. Spleen and heart weights in treated males (0.324 and 1.016 g, respectively) were significantly lower than those of controls (0.456 and 1.220 g, respectively), and brain/body weight ratios were higher (0.844 in treated versus 0.74 in control).
Test condition	:	Ten rats (5 per sex) were treated with test material and another 10 served as controls. Backs of all rats were shaved prior to treatment. Shaved skin of control animals was rubbed daily with a glass rod. Test material was applied to the shaved backs of test animals in a split dose (2 ml/kg/day) five hours apart for 14 consecutive days. All animals had a modified Elizabethan collar placed on the neck to prevent oral ingestion. Excess test material was wiped off hair and cages daily. Body weights and water consumption were determined daily, and food consumption was measured three times per week. Urinalyses (dip stick) were performed at an unspecified time. Serum chemistries were taken and standard organs

were removed upon necropsy. Brain, testes, liver, kidneys, ovaries, heart and spleen were weighed. A standard set of organs (including ovaries and testes) were examined microscopically.

Reliability : (2) valid with restrictions. Purity of test material was not noted. Only one dose was used.

17.10.2001 (10)

5.5 GENETIC TOXICITY 'IN VITRO'

Type	:	Ames test
System of testing	:	Salmonella typhimurium strains TA98, TA100, TA1535, TA1537, TA1538
Concentration	:	.003, .01, .03, .1, .3, 1, 3, 10 %
Cytotoxic conc.	:	10%
Metabolic activation	:	with and without
Result	:	ambiguous
Method	:	other
Year	:	1980
GLP	:	no
Test substance	:	other TS
Remark	:	The positive result in TA98 is questionable, since 1) the number of revertants induced was just at the level chosen for significance (3-fold increase), 2) a 10-fold increase in concentration of test material did not cause a dose-dependent increase in the number or revertants , 3) the positive control induced a significantly greater number of revertants than the test material, and 4) higher concentrations of test material that were not toxic (0.1 and 0.3%) did not increase the number of revertants with respect to control. Although the authors concluded that the test material was positive in this assay, the fact that mutagenicity was not noted in other strains with frame-shift mutations (i.e. TA1538 and TA1537), along with the questionable positive result with TA98 suggests that mutagenicity of the test compound is ambiguous.
Result	:	The 10% concentration of test material was toxic (method of determining toxicity was not stated) to strains TA1535, TA1537, and TA1538. Test material was positive for mutagenicity in strain TA98 in the presence of S-9, as 0.003%, 0.01% and 0.03% caused a dose-dependent increase in revertants that was at least three times greater than that of control. In strain TA98, the positive control induced a significant increase in revertants.
Test condition	:	Metabolic activation system: S9 was prepared from adult, male Sprague-Dawley rats (200-300 g) that had been induced by an i.p. injection of Aroclor-1254 (500 mg/kg) five days before sacrifice. Administration: The five bacterial tester strains were characterized for the genetic markers described by Ames et al. (Mut. Res 31:347-364, 1975). Broth cultures of the five tester strains were grown at 37 +/- 1 degrees C for 16-20 hours, and 100 microliters containing 1-3 x 10E8 bacteria were added to 2 ml molten top agar supplemented with 0.6% NaCl, 0.05 mM histidine.HCl and 0.05 mM biotin. Test material was diluted in acetone and immediately added (100 microliters) to all strains of bacteria at 0.003%, 0.01%, 0.03%, 0.1%, 0.3%, 1%, 3%, and 10%. Untreated cultures and cultures treated with solvent (100 microliters acetone) or positive control chemicals were also prepared. Triplicate plates were prepared per treatment. Additional cultures were prepared in triplicate with S-9 (0.5 ml). The highest concentration of test material incubated in the presence of S-9

was 0.3%. Plates were incubated at 48 hours at 37 +/- 1 degrees C, after which time the number of revertant colonies was counted by an automatic colony counter.
The numbers of revertant colonies from each set of 3 plates were averaged and the standard deviation was calculated. The test material was considered a mutagen if the average number of revertant colonies at the first level considered for an increase was 3 times that of the solvent control, and a dose-related increase in revertants was found. Tests were considered valid if all five concentrations of test compound and S-9 mix were negative for bacterial growth, the average number of revertant colonies were within acceptable ranges and the average number of revertant colonies in the positive controls was at least 5 times that of the solvent control.

Test substance : The test material was listed as 85% diallyl diglycol carbonate with 15% monomeric substances

Reliability : (2) valid with restrictions. The result is ambiguous. The study passed a QA audit.

17.10.2001 (21)

Type : Unscheduled DNA synthesis
System of testing : primary rat hepatocytes
Concentration : 0.313 nl/ml to 10 nl/ml
Cytotoxic conc. : 2.5 nl/ml
Metabolic activation : without
Result : negative
Method : other
Year : 1980
GLP : no
Test substance : as prescribed by 1.1 - 1.4
Result : The test material was inactive. The test was valid as concentrations of test material greater than or equal to 7.5 nl/ml reduced viability by approximately 50% at 2 and 20 hours, and the positive control induced an average of 11.28 grains/nucleus, caused 75.3% of nuclei to have 6 or more grains, and caused 13.3% of nuclei to have 20 or more grains.

Test condition : Test material: Stock solutions of test material (500 microliters/ml) were prepared in acetone and aliquot into Williams' Medium E (containing 1% serum) to achieve nine final test concentrations ranging from 0.156 nl/ml to 10 nl/ml.

Test: Hepatocytes (0.5 x 10E6) grown on plastic coverslips were incubated at 37 degrees C with 2.5 ml William's Medium E (WME) containing 1% fetal serum and various concentrations of test material, 1% acetone (solvent control) or 400 micrograms/ml 2-acetylaminofluorine (positive control) (N=6 per treatment). After 1 hour of treatment, test material was removed by washing twice with WME that did not contain bovine serum. Three cultures were refed and returned to the incubator. Cell counts from these cultures were determined at 2 and 24 hours after treatment.

The other three cultures/treatment were refed with 2.5 ml WME containing 10% serum (complete WME) containing 1 microcurie/ml of 3H-thymidine and incubated for 3 hours. Labeling was terminated by washing cultures with complete WME containing 1mM thymidine. Cells were harvested, placed on glass slides, coated with Kodak NTB2 emulsion, and stored in light-tight boxes for 2 weeks at 4 degrees C They were than developed, fixed, and stained with hematoxylin and eosin.

Cells were examined microscopically and unscheduled DNA synthesis (net nuclear grain count) was measured by counting nuclear grains in 50

randomly selected cells and subtracting the background count. Only normal-appearing nuclei were scored. If the actual background count was greater than the nuclear count, a value of 0 was assigned.

The test material was considered active in the assay if there was an increase in the mean nuclear grain count of at least 6 grains/nucleus in excess of the control and/or the percent of nuclei with 6 or more grains increased 10% above the negative control, or the percent of nuclei with 20 or more grains was 2% greater than control. The test material was considered inactive if none of the conditions were met and the assay included concentrations that were toxic.

Reliability : (2) valid with restrictions. The study passed a QA audit. Purity of test material was not noted.

12.09.2001 (17)

Type : Chromosomal aberration test
System of testing : human peripheral blood lymphocytes
Test concentration : 313 to 5000 ug/ml for non-activated 4 and 20 hr exposure groups; 125 to 1250 ug/ml for S9 activated 4 hr group
Cycotoxic concentr. : > or = 5000 ug/ml in non-activated 4 and 20 hr exposure groups; > or = to 1500 ug/ml in S9 activated 4hr exposure group
Metabolic activation : with and without
Result : negative
Method : OECD Guideline 473
Year : 2004
GLP : yes
Test substance : as prescribed by 1.1 - 1.4

Method : A preliminary toxicity test was performed to establish the dose range for testing in the cytogenetic test. The chromosome aberration assay was used to evaluate the clastogenic potential of the test article. Dimethyl sulfoxide (DMS) was determined to be the solvent of choice based on the solubility of the test article and compatibility with the target cells. The test article was soluble in DMSO at a concentration of 500 mg/ml, the maximum concentration tested for solubility.

In the preliminary toxicity assay, the maximum dose tested was 5000 ug/ml. Human peripheral blood lymphocytes were treated in the absence and presence of an Aroclor-induced S9 activation system for 4 hours, and continuously for 20 hours in the absence of S9 activation. The test article was soluble in DMSO at all concentrations tested. Visible precipitate was observed in treatment medium at concentrations > or = to 1500 ug/ml at the beginning of the treatment period. Concentrations < or = to 500 ug/ml were soluble in treatment medium at the beginning of the treatment period while concentrations < or = to 1500 ug/ml were soluble in treatment medium at the end of the treatment period. Selection of dose levels for the chromosome aberration assay was based on a reduction in the mitotic index relative to the solvent control. Substantial toxicity (at least 50% reduction in mitotic index relative to the solvent control) was observed at doses > or = to 5000 ug/ml in the non-activated 4 and 40 hour exposure groups. Substantial toxicity was observed at dose levels > or = to 1500 ug/ml in the S9 activated 4 hour exposure group. Based on these findings, the doses chosen for the chromosome aberration assay were 313, 625, 1250, 2500 and 5000 ug/ml for both non-activated 4 and 20 hour exposure groups, and 125, 250, 500, 750, 1000 and 1250 ug/ml for the S9 activated 4 hour exposure group.

In the chromosome aberration assay, the cells were treated for 4 and 20 hours in the non-activated test system and for 4 hours in the S9 activated test system. All cells were harvested 20 hours after treatment initiation. The test article was soluble in DMSO at all concentrations tested. Visible precipitate was observed in treatment medium at concentrations > or = to 625 ug/ml at the beginning of the treatment period. Concentrations < or = to 500 ug/ml were soluble in treatment medium at the beginning of the treatment period while concentrations < or = to 1250 ug/ml were soluble in treatment medium at the end of the treatment period. Visible precipitate was observed in treatment medium at concentrations > or = to 2500 ug/ml at the conclusion of treatment period. Selection of doses for microscopic analysis was based on precipitation of test article in treatment medium or mitotic inhibition (the lowest dose with at least 50% reduction in mitotic index, relative to the solvent control and two lower doses) in all harvests.

Result : The percentage of cells with structural or numerical aberrations in the test article-treated groups was not significantly increased above that of the solvent control at any dose level (p>0.05, Fisher's exact test). The results of the assay are summarized in the following table:

Treat. Time (hrs)	Rec. Time (hrs)	Harvest Time (hrs)	S9	Mitotic Index Reduction[1] at Highest Dose Scored (ug/ml)	LED[2] for Structural Aberr. (ug/ml)	LED for Numerical Aberr. (ug/ml)
4	16	20	-	21% @ 2500	none	none
20	0	20	-	77% @ 2500	none	none
4	16	20	+	64% @ 1250	none	none

[1]Relative to the solvent control at high dose evaluated for chromosome aberrations
[2]Lowest effective dose level

Test substance : Purity: 100%

Conclusion : Based on the findings of this study, diallyl diglycol carbonate was concluded to be negative for the induction of structural and numerical chromosome aberrations in the in vitro mammalian chromosome aberration test using human peripheral lymphocytes.

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

19.12.2005 (3)

5.6 GENETIC TOXICITY 'IN VIVO'

5.7 CARCINOGENITY

5.8 TOXICITY TO REPRODUCTION

Species : rat
Sex : male/female
Strain : Sprague-Dawley
Route of admin. : dermal

Exposure period	:	repeat dose males: at least 42 days (14 days premating, 14 days mating, and 14 days postmating); reproductive dose females: up to 48 days (2 weeks before pairing, during pairing, and gestation days 0 to 20)
Frequency of treatm.	:	daily, for 6 hours/day
Premating exposure period		
Male	:	14 days
Female	:	14 days
Duration of test	:	repeat dose males: at least 42 days; reproductive dose females: up to 48 days
Doses	:	150, 454, and 1030 mg/kg/day
Control group	:	other: yes, concurrent with saline
NOAEL parental	:	= 1030 mg/kg bw
NOEL F1 offspring	:	= 1030 mg/kg bw
other: NOEL reproductive performance	:	= 1030 mg/kg bw
Result	:	No-Observable-Effect Level (NOEL) of reproductive performance was 1030 mg/kg/day, the high dose level evaluated.
Method	:	OECD Guideline 422
Year	:	2005
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4

Method : This study was comprised of two components, a repeat dose toxicity study with neurobehavioral evaluations (Section 5.4) and a reproduction/developmental toxicity screening study. The purpose of the reproduction/developmental toxicity screening component was to provide information on possible effects on male and female reproductive performance, such as gonadal function, mating behavior, conception, development of the conceptus, and parturition. Both the repeat dose and the reproductive/developmental components were comprised of three treatment groups and a saline-treated control group. Each repeat dose group contained ten male and ten female Sprague-Dawley rats. The ten male animals of each repeat dose group were also utilized for the reproductive/developmental component of the study. Each reproductive group contained ten female Sprague-Dawley rats. The test article was administered dermally once daily via occlusion for 6 hours. An anterior and posterior site on the back was shaved and dosing was alternated between the two sites daily. Six hours after test article administration, the occlusive cover was removed, and the site was washed, rinsed and blotted dry. Dose levels were 150, 454, and 1030 mg/kg/day and to achieve these dose levels, the neat test article was administered at respective dose volumes of 0.13, 0.4, and 0.9 ml/kg. The dose volumes were derived on the basis of the density of the test article, 1.143 grams/ml. Males in the repeat dose component were treated for at least 42 consecutive days, while females in the reproductive component were treated for two weeks before pairing, during pairing, and from Gestation Days (GD) 0 to 20. The control animals received 0.9% sodium chloride, USP, at a volume of 0.9 mg/kg for the same duration as the treated animals.

All rats were observed twice daily for morbidity, mortality, and signs of injury. Observations of the animals included

clinical signs, dermal evaluation (daily for the first 20 days, and weekly for the remainder of the study for erythema and edema according to Draize scale), body weights (at initiation, weekly and at test termination; reproductive dose females also weighed on Days 0, 7, 14 and 20 of gestation), and food consumption (recorded weekly, except during the mating period; for females with litters, food consumption was recorded for Days 0 and 4 of lactation). After two weeks of treatment, the animals were cohabited nightly with males from the repeat dose component, one male to one female, from the same treatment group, for up to 14 days. Females were evaluated daily for evidence of mating. Once mating was confirmed (GD 0), females were separated from the males for the remainder of gestation, and allowed to deliver and nurse litters until Postnatal Day (PND) 4. Litter size (number of stillborn and live born pups) and pup evaluations (body weight, sexing, and external examination) were recorded at birth and PND 4. Pups were euthanized and externally examined on PND 4 and the carcasses were discarded without further examination. Complete necropsies were performed on all animals (in both the repeat dose and reproductive components). Selected organs and tissues were collected, weighed, and preserved.

Statistical analysis methods included Levene's Test, Dunnett's Test, Group Pair-wise Comparisons, Fishers's Exact Test, and Aresin-Square Root Transformation, and Covariate Analysis.

Result : No effect of treatment was evident from mortality, clinical evaluations, dermal evaluations, body weights, food consumption, organ weights, macroscopic, or microscopic evaluations. In the reproductive component, no effect of treatment was evident for reproductive performance (male and female fertility and mating indices), gestation and lactation body weights or food consumption, gestation length, or litter size to PND 4.

Conclusion : The No-Observable-Effect Level (NOEL) for reproductive performance was 1030 mg/kg/day, the highest dose level evaluated.

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint

20.12.2005 (22)

5.9 DEVELOPMENTAL TOXICITY/TERATOGENICITY

Species : rabbit
Sex : female
Strain : New Zealand white
Route of admin. : dermal
Exposure period : Days 6 to 18 of gestation, 6 hours/day
Frequency of treatment : daily
Duration of test : To Day 29 of gestation
Doses : 0.1, 0.5, 1.0 ml/kg/day
Control group : yes

NOEL Teratogen	:	= 0.1 ml/kg bw
Method	:	other
Year	:	1986
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4
Remark	:	The significance of the ocular effects noted at the 0.5 and 1.0 ml/kg/day doses is unclear, since only a few animals were affected and the incidence was not dose-dependent. Since the ocular effects and skeletal findings only occurred at doses that were toxic to dams, they are not considered to be of teratological significance.
Result	:	Six rabbits treated with 1 ml/kg/day died and 1 was sacrificed in a moribund condition. Two, 0, 3 and 8 rabbits treated with 0, 0.1, 0.5 or 1.0 ml/kg/day (respectively) were sacrificed before study termination due to abortion or early littering. Skin lesions were present in some animals from all treatment groups. The affected area was related to dosage. All rabbits in the 1.0 ml/kg/day group lost weight throughout the study, and those treated with 0.5 ml/kg/day had a significant overall weight loss between days 6 and 18 of gestation. Body weights and weight gains of rabbits treated with 0.1 ml/kg/day were similar to controls. Pale foci, firmness and/or an irregular surface were common findings in the liver of animals that were treated with 1.0 ml/kg/day and died or were sacrificed prior to study termination. Other findings in these animals included pale foci or pale areas on the heart, kidneys and/or mesentary. In the 0.5 ml/kg group, 1 rabbit had firmness and an irregular surface to the liver and a second rabbit had pale foci on the mesentary. The pregnancy rate in all groups was at least 88.9%. For animals alive on day 29, the ovarian and uterine parameters (number of corpora lutea, implantation sites, live fetuses, dead fetuses, resorptions, fetal weights and pre-and post-implantation losses) in the 0.1 and 0.5 ml/kg/day groups were similar to controls. For the 1.0 ml/kg group, there was a high incidence of resorptions in animals dying, aborting, littering early or sacrificed preterminally. However, the uterine parameters of the 3 females in this group that survived to day 29 were similar to those of controls. The incidence of major malformations and minor skeletal anomalies in litters from treated females examined at study termination was not significantly different from control. The overall incidence of visceral anomalies in treated groups also was not different from control. In the 0.5 and 1.0 ml/kg/day groups, the incidence of small or oval lenses (6 fetuses from 3 litters in the 0.5 ml/kg/day group and 4 fetuses from 2 litters in the 1.0 ml/kg/day group) was slightly higher than control (N=1). One of the affected fetuses in the 1.0 ml/kg/day group and 3 in the 0.5 ml/kg/day group also had ocular opacities. Other ocular findings (lenses formed in 2 layers) were also noted in 3 fetuses from the 0.5 ml/kg/day group and 1 from the high dose group. In the 0.5 ml/kg/day group there was a significant decrease in the incidence of single thirteenth ribs and accompanying increases in the incidences of paired thirteenth ribs and 27 presacral vertebrae.
Test condition	:	Eighty-five rabbits were received into the study. Seventy-two were randomly chosen for use and were acclimated for 4 weeks. Rabbits were luteinized with an iv. injection of 50 IU of chorionic gonadotropin 19 days and 2-4 hours prior to insemination. Proven males of the same strain and source (N= 18) were used to provide semen samples for insemination. Each sperm sample given to females (0.6 ml) was a diluted, pooled sample

from at least 4 males, which contained in excess of 2.0 x 10E7 spermatozoa/ml. Females were 22-23 weeks old and weighed from 3.2 to 4.3 kg on the day of insemination.

All animals were shaved on approximately day 0 of gestation. Eighteen rabbits/group were dosed on the shaved area with sterile isotonic saline (1 ml/kg/day), or 0.1, 0.5 or 1.0 ml/kg/day CR-39 monomer (114, 572 or 1143 mg/kg/day) from day 6 to day 18 of gestation, inclusive. Collars were placed on the animals immediately prior to dosing. Collars and test material were removed after 6 hours.

Animals were checked for abnormal condition daily throughout the acclimation and gestation periods. Dams were weighed on days 0, 6, 9, 12, 15, 18, 24 and 29 of gestation. Any signs of abortion or premature delivery were recorded. Dams that died were given completed gross pathological examinations. Dams that aborted or littered early were sacrificed. All aborted material was examined. All fetuses aborted prior to day 27 were examined externally and preserved. All that aborted on and after day 27 or littered early were examined as for fetuses at termination.

Dams were sacrificed on day 29 of gestation and were given complete gross pathological examinations. Detailed external and internal examinations of each fetus was performed. Samples of tissue from two lobes of the liver from 1 fetus/sex/litter were preserved. Fetuses with major malformations were photographed. Fetal findings were grouped according to whether they were major malformations, minor anomalies, or common variants.

Statistical analyses were performed on both the body weights of all does and those from rabbits pregnant with live litters at term. Group mean body weights and weight gains were calculated and analyzed. Pregnancy (number of pregnant rabbits/number inseminated x 100) and abortion rates (number of rabbits with abortion/ number pregnant x 100), pre and post-implantation loss, the group mean live litter size, corpora lutea count, number of implants, number of resorptions, individual and group litter means for the sex ratio, litter and group mean fetal weights were analyzed using appropriate statistical methods.

The overall and individual indices of litters and fetuses with major malformations and minor anomalies in each test group were compared with the control values using appropriate statistical methods. The litter mean percentage of common skeletal variants was calculated and statistical analyses performed.

Conclusion : Systemic toxicity in dams and embryotoxicity (as evidenced by significantly increased ocular anomalies) occurred in the 0.5 ml/kg/day and 1.0 ml/kg/day groups. There was a high incidence of embryolethality (as evidenced by resorptions) in rabbits treated with 1.0 ml/kg/day that aborted, died, or were sacrificed in a moribund condition. Neither embryotoxicity nor lethality occurred at the 0.1 ml/kg/day dose.

Reliability : (1) valid without restriction
25.10.2001

(20)

Species : rat
Sex : male/female
Strain : Sprague-Dawley
Route of admin. : dermal

Exposure period	:	repeat dose males: at least 42 days (14 days premating, 14 days mating, and 14 days postmating); reproductive dose females: up to 48 days (2 weeks before pairing, during pairing, and gestation days 0 to 20)
Frequency of treatm.	:	daily for 6 hrs/d
Duration of test	:	repeat dose males: 42 days; reproductive dose females: up to 48 days
Doses	:	150, 454, and 1030 mg/kg/day
Control group	:	other: yes, concurrent with saline
NOAEL maternal tox.	:	1030 mg/kg bw
NOEL teratogen.	:	1030 mg/kg bw
Method	:	other: OECD guideline 422
Year	:	2005
GLP	:	yes
Test substance	:	as prescribed by 1.1 - 1.4

Method :

This study was comprised of two components, a repeat dose toxicity study with neurobehavioral evaluations (Section 5.4) and a reproduction/developmental toxicity screening study. The purpose of the reproduction/developmental toxicity screening component was to provide information on possible effects on male and female reproductive performance, such as gonadal function, mating behavior, conception, development of the conceptus, and parturition. Both the repeat dose and the reproductive/developmental components were comprised of three treatment groups and a saline-treated control group. Each repeat dose group contained ten male and ten female Sprague-Dawley rats. The ten male animals of each repeat dose group were also utilized for the reproductive/developmental component of the study. Each reproductive group contained ten female Sprague-Dawley rats. The test article was administered dermally once daily via occlusion for 6 hours. An anterior and posterior site on the back was shaved and dosing was alternated between the two sites daily. Six hours after test article administration, the occlusive cover was removed, and the site was washed, rinsed and blotted dry. Dose levels were 150, 454, and 1030 mg/kg/day and to achieve these dose levels, the neat test article was administered at respective dose volumes of 0.13, 0.4, and 0.9 ml/kg. The dose volumes were derived on the basis of the density of the test article, 1.143 grams/ml. Males in the repeat dose component were treated for at least 42 consecutive days, while females in the reproductive component were treated for two weeks before pairing, during pairing, and from Gestation Days (GD) 0 to 20. The control animals received 0.9% sodium chloride, USP, at a volume of 0.9 mg/kg for the same duration as the treated animals.

All rats were observed twice daily for morbidity, mortality, and signs of injury. Observations of the animals included clinical signs, dermal evaluation (daily for the first 20 days, and weekly for the remainder of the study for erythema and edema according to Draize scale), body weights (at initiation, weekly and at test termination; reproductive dose females also weighed on Days 0, 7, 14 and 20 of gestation), and food consumption (recorded weekly, except during the mating period; for females with litters, food consumption was recorded for Days 0 and 4 of lactation). After two weeks of treatment, the animals were cohabited nightly with males from the repeat dose component, one male to one female, from the same treatment group, for up to 14 days. Females were evaluated daily for evidence of mating. Once mating was confirmed (GD 0), females were separated from the males for the remainder of gestation, and allowed to deliver and nurse litters until Postnatal Day (PND) 4. Litter size (number of stillborn and live born pups) and pup evaluations (body weight, sexing, and external examination) were recorded at birth and PND 4. Pups were euthanized

and externally examined on PND 4 and the carcasses were discarded without further examination. Complete necropsies were performed on all animals (in both the repeat dose and reproductive components). Selected organs and tissues were collected, weighed and preserved.

Statistical analysis methods included Levene's Test, Dunnett's Test, Group Pair-wise Comparisons, Fishers's Exact Test, and Aresin-Square Root Transformation, and Covariate Analysis.

Result : There was no effect of treatment evident from mortality, clinical evaluations, dermal evaluations, body weights, food consumption, organ weights, macroscopic, or microscopic evaluations. In the developmental component, no effect of treatment was evident for gestation length, litter size, pup body weight, pup sex ratios, pup survival, or pup external examinations to PND 4.

Conclusion : The No-Observable-Effect Level (NOEL) for developmental toxicity was 1030 mg/kg/day, the highest dose level evaluated.

Reliability : (1) valid without restriction
Guideline study

Flag : Critical study for SIDS endpoint
20.12.2005 (22)

5.10 OTHER RELEVANT INFORMATION

Type : Metabolism

Result : Diallyl carbonate (17 pg) and monoallyl diglycol carbonate (59 pg) were detected at the first sampling time (0.5 days). The concentration of diallyl carbonate (DC) remained fairly steady over 7 days, and the concentration of monoallyl diglycol carbonate (MADC) decreased (to 40 pg by 3 days), then increased to 51 pg (by 7 days). MADC production increased and DC production decreased in the presence of imidazole. The amount of DC and MADC produced by day 1 in the presence of imidazole were 7 and 160 pg, respectively. In the presence of imidazole, the concentration of MADC also decreased, and then increased with time (to 62 pg at 23 days and 99 pg at 7 days). In flasks incubated for 15 days, there was a slight decrease in the amount of DC and MADC detected from day 8 to day 15 (the only times sampled).

Test condition : Sixty g of diallyl diglycol carbonate plus 60 g buffer (0.05 M total phosphate adjusted to pH 7.40, and 0.9% total salt with NaCl) were placed in a three-neck 250 ml reaction flask fitted with a septum sampling port, valved port, and a mechanical stirrer. An additional reaction vessel was prepared containing test material and the catalyst imidazole (units not listed but presumed to be g). The reaction took place at 37 degrees C over 15 days. Samples of the two phases (brine and resin phase) were taken at various time points and analyzed by gas chromatography for the metabolites diallyl carbonate and monoallyl diglycol carbonate. Reactor stirrers were stopped 10-15 minutes before sampling to allow for phase separation.

Additional reaction vessels (50 ml) were prepared containing 15 test material and 15 g buffer, with and without imidazole (units not listed but presumed to be g). These reactions were allowed to continue for 7 days. Samples from both phases in the two reaction vessels were taken at various time points and analyzed (as described above).

Concentrations of diallyl carbonate and monoallyl diglycol carbonate in the brine and resin phase and the total in both phases were reported.

Conclusion : This study suggests that mono allyl diglycol carbonate formed by hydrolysis

of diallyl diglycol carbonate is metabolized to other products at biological conditions and that diallyl carbonate is not.

14.09.2001 (25)

5.11 EXPERIENCE WITH HUMAN EXPOSURE

Memo : Irritant contact dermatitis
Result : Of the 7 operators tested, 1 (who had a previous history of nickel sensitivity) developed an allergic reaction to nickel sulphate 5% pet. Minor irritant reactions occurred with 0.1% DAGC plus 3% IPP. Similar irritant reactions to this mixture were seen in 5 control subjects. Other materials tested negative.
Test condition : Out of 40 operators exposed to diallylglycol carbonate monomer (DAGC) during manufacture of plastic lenses, two developed irritation of the face while working in the filling area. These 2 operators, and 5 others developed severe skin eruptions within hours of working in the stripping and edge-cleaning area. The most severely affected individual developed swelling of eyelids, arms, thighs, abdomen, mid-back and neck after 9 days of working in the process.

The 7 operators were subsequently patch tested with the International Contact Dermatitis Research Group (ICDRG) standard series, 0.1% DAGC, 0.1% DAGC plus 3% isopropyl percarbonate (IPP), 0.1% acrolein, and 0.1% allyl alcohol. The solvent for all materials was methyl ethyl ketone.
Test substance : Gas chromatographic and HPLC analysis of the DAGC revealed minor contamination with acrolein and 28 ppm allyl alcohol.
Conclusion : Reactions were irritant, rather than allergic in origin.
Reliability : (2) valid with restrictions
17.10.2001 (12)

Memo : Irritant contact dermatitis
Remark : Out of eleven women who developed contact dermatitis after exposure to diallylglycol carbonate, the lesions appeared within hours of first contact in 5 cases, and after a few days in 6 cases. Evolution tended to resolve in 30 to 50% of cases, with persistence or relapse in 50 to 70% if the worker stayed at the same work place. Spontaneous regression was observed in 4 women who did not change workplace, and in 7 who did. In no case did the lesions have a clearly vesicular appearance suggestive of an allergic response. There is no difference between the response of controls to pure monomer, and those with 2% isopropyl percarbonate (IPP), suggesting that IPP is not the irritating substance.
17.10.2001 (9)

Memo : Irritant contact dermatitis
Remark : Patch tests with undiluted diallylglycol carbonate (DAC) provoked a collective reaction in 20/20 normal subjects after 48 hours, with edema and infiltration extending further than the site of application, and palpable to the touch.

Groups of 9-22 normal subjects were tested with 50%, 20%, 10%, 2% and 1% DAC in olive oil to determine the lowest concentration that was irritating. All subjects exposed to concentrations >= 10%, 9/12 exposed to 2%, and 5/22 exposed to 1% experienced reactions.

In subjects exposed to 2 or 5% DAC, there were no histologic signs of

allergic intolerance. In all subjects who developed irritation, there was an acute inflammatory edema of the papillary dermis, with diapedesis of neutrophils. Some monocytes were seen in cases of slight irritation.

Tests with possible contaminating substances (allyl alcohol, acrolein and diallyl carbonate) also were carried out. Concentrations of up to 10% allyl alcohol and diallyl carbonate produced reactions in only 1/8 subjects. Exposure of a group of normal subjects to 1 and 10% acrolein resulted in irritation in 6/48 and 8/8 subjects. Unlike with DAC, the epidermis was primarily affected.

Conclusion : DAC produces irritant dermatitis in a high percentage of dermally-exposed individuals. Contaminants are not likely to be the cause of irritation.

17.10.2001

(9)

(1) Dial WR, Bissinger WE,. DeWitt BJ, Strain F. 1955. Polymerization control in casting a thermosetting resin. J Ind Eng Chem 47: 2447-2451.

(2) Ebbens K. 1971. Acute toxicity studies with CR-39, allyl diglycol carbonate. Industrial Bio-Test Laboratories, Inc. Report IBT A254, Dated September 10, 1971.

(3) Gudi R, Rao M. 2004. Diallyl Diglycol Carbonate: In Vitro Mammalian Chromosome Aberration Test. BioReliance, Study Number AA87VF.341.BTL, Dated September 22, 2004.

(4) Humphrey J. 1979. Delayed contact hypersensitivity study in guinea pigs of CR-39 monomer. Hill Top Research, Inc. Reference 79-0057-21.

(5) Karel L, Landing BH, Harvery TS. 1947. The intraperitoneal toxicity of some glycols, glycol ethers, glycol esters and phthalates in mice. Fed Proc 6: 342. Also Journal of Pharmacology and Experimental Therapeutics 90: 338, 1947.

(6) Kingery A, Mayhew DA. 1981a. Acute oral toxicity study in albino rats with CR-39 (479-768). Wil Research Laboratories, Inc. Report WIL-80209, Dated October 22, 1981.

(7) Kingery AF, Mayhew DA. 1981b. Acute dermal toxicity study in albino rabbits with CR-39. Wil Research Laboratories, Inc. Project Number WIL-80209, Dated October 22, 1981.

(8) Kingery AF, Mayhew DA. 1981c. Acute dermal toxicity study in albino rabbits with CR-39/NIRA. Wil Research Laboratories, Inc. Project Number WIL-80210, Dated October 22, 1981.

(9) Lacroix M, Burckel H, J Fossereau J, Grosshan E, Cavelier C, Limasset JC, Ducos P, Gradinski D, Dupra P. 1976. Irritant dermatitis from diallylglycol carbonated monomer in the optical industry. Contact Dermatitis 2: 183-195.

(10) Lequire M, Sigler FW, Mayhew D. 1980. Fourteen-day range finding study in rats with diallyl diglycol carbonate. Wil Research Laboratories, Inc. Project Number WIL-80111, Dated August 1, 1980.

(11) Lewis RJ, Sr. (Ed.). 1997. Hawley's Condensed Chemical Dictionary. 13th Ed. New York, NY: John Wiley & Sons, Inc.

(12) Lovell CR, Rycroft RJG, Vale PT. 1988. Irritant contact dermatitis from diallylglycol carbonate monomer and its prevention. Contact dermatitis 18: 284-286.

(13) Maziarz TP. 1983a. Toxicity of CR-39 to the freshwater alga Selanastrum capricornutum. EG&G Bionomics Report Number BP-83-4-51, Dated April 1983.

(14) Maziarz TP. 1983b. Toxicity of CR-39 to the marine alga Skeletonema costatum. EG&G Bionomics Report Number BP-83-1-4, Dated January 1983.

(15) McGahan M, Mahew D. 1980. Fourteen-day range finding study in rats with diallyl diglycol carbonate. Wil Research Laboratories, Inc., Report WIL-79302. Dated January 21, 1980.

(16) Mullee DM. 2005. Diallyl diglycol carbonate (CAS No. 142-22-3): Determination of hydrolysis as a function of pH. SafePharm Laboratories Ltd, SPL project number 1234/150, Dated April 13, 2005.

(17) Myhr BC, Brusick DJ. 1980. Evaluation of CR-39 in the primary rat hepatocyte unscheduled DNA synthesis assay. Litton Bionetics Inc. Project Number 20991, Dated March 25, 1980.

(18) RBM Instituto di Ricerche Biomediche. 1994. RAV 7 Ready biodegradability (closed bottle test). Report Exp. No. 930855, Dated May 30, 1994.

(19) Reddington K. 1979. Skin irritation studies of CR-39 monomer. Hill Top Research Inc., Reference 79-0056-21, Dated June 4, 1979.

(20) Robinson K, Pinsonneault L, Procter BG. 1986. A teratology study of CR-39 R monomer by dermal application in the rabbit. BioResearch Laboratories Ltd., Project No. 81892, Dated January 14, 1986.

(21) Schechtman LM, Curren RD, Parmar AS, Sinsky PM. 1980. Activity of T1562 in the Salmonella/Microsomal assay for bacterial mutagenicity. Microbiological Associates Report Dated January 16, 1980.

(22) Schroeder RE. 2005. Diallyl diglycol carbonate: Combined repeat dose rat dermal toxicity study with a reproduction/developmental toxicity screening test (OECD 422). MPI Research, Inc., Study Number 991-002, Dated September 28, 2005.

(23) Sousa JV. 1982. Acute toxicity of CR-39 to Bluegill (Lepomis macrochirus). EG&G Bionomics Report Number BW-82-10-1293. Dated October 1982.

(24) Strain F, Bissinger WE, Dial WR, Rudoff H, Dewitt BJ, Stevens HC, Langston JH. 1950. Esters of peroxycarbonic acids. J. Amer. Chem. Soc., 72: 1254-1263.

(25) Subak Jr EB, Beauregard P. 1981. A study of C-39 hydrolysis at biological conditions. PPG Industries Inc. Report BRC 22242. Dated April 10, 1981.

(26) Suprenant D, LeBlanc GA, Bentley RE. 1982. Acute toxicity of C-39 to the water flea (Daphnia magna). EG&G Bionomics Report BW-82-11-1294. Dated November 1982.

(27) Ward GS. 1982a. Acute toxicity of CR-39 to mysid shrimp (Mydiopsis bahia). EG&G Bionomics Report Number BP-82-11-121. Dated November 1982.

(28) Ward GS. 1982b. Acute toxicity of CR-39 to sheepshead minnows (Cyprinodon variegatus). EG&G Bionomics Report Number BP-82-11-126. Dated November 1982.